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ABSTRACT

The purpose of this study was to further investigate performance differences between reflective and impulsive subjects on a recognition memory task. Other researchers have proposed that these differences are based on visual analysis and that they are relatively independent of verbal processes. To test this contention, a sentence recognition task was presented either visually or auditorily to 20 reflective and 20 impulsive undergraduate subjects. Results indicated that verbal recognition memory is sensitive to both conceptual tempo and stimulus presentation mode. (Author)

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The Effect of Stimulus Presentation Mode and Cognitive Style on Sentence Recognition Memory

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The purpose of this study was to further investigate performance differences between reflective and impulsive subjects on a recognition memory task. Other researchers have proposed that these differences are based on visual analysis and that they are relatively independent of verbal processes. To test this contention, a sentence recognition task was presented either visually or auditorily to twenty reflective and twenty impulsive undergraduate subjects. Results indicated that verbal recognition memory is sensitive to both conceptual tempo and stimulus presentation mode.

In recent years individual differences in cognitive style have prompted an extensive amount of research. Kagan's reflection-impulsivity (R-I) distinction has received much attention as a potentially useful dimension along which to conceptualize such differences. Although several methods have been developed to classify subjects as reflective or impulsive, the Matching Familiar Figures Test (MFF) is most frequently used. The task consists of choosing the only one of several similar figures that is identical to a standard. Reflective performance is associated with relatively longer response latencies and few errors. Subjects who respond in this manner are described as having a slow conceptual tempo. On the other end of the continuum are impulsive subjects who seem to report the first solution that occurs to them and commit many errors.

Even the earliest studies in this area indicated that reflection-impulsivity may have important educational implications. First, it appears to be influential in any problem-solving situation in which the subject possesses the basic skills necessary to solve the problem but experiences at least a moderate degree of response uncertainty. In most such cases response time correlates negatively and substantially with errors (Kagan, 1965a). Secondly, the dimension has been consistently shown to be stable over time and across tasks (Kagan, Rosman, Day, Albert, & Phillips, 1964; Kagan, 1965a; Kagan, 1965b, Kagan, 1966 ; Messer, 1970), and relatively independent of verbal intelligence, particularly in young children (Kagan, Pearson, & Welch, 1966; Hall & Russell, 1974; Lewis, Rauch, Goldberg, & Dodd, 1968; Massari & Massari, 1973).

Kagan contends that R-I is a broad, pervasive disposition that influences both cognitive and affective behavior (Kagan, 1965a). Many studies have indeed shown differences in the performances of reflective and impulsive subjects on a wide variety of tasks, including word recognition (Kagan, 1965a), problem-solving strategies (Ault, 1973: Denny, 1973), inductive reasoning (Kagan, 1966), and tests of creativity (Fuqua, Bartsch, & Phye, 1975). The superior performances of reflectives in all these situations has led some researchers to seek differences in specific perceptual and/or cognitive processes which may underlie the R-I dichotomy. The ability to sustain attention (Zelniker, 1972), high information processing speeds (Weiner, 1975), efficient visual scanning strategies (Siegelman, 1969; Drake, 1970; Ault, Crawford, & Jeffrey, 1972), and cognitive flexibility in adapting to task demands (Bush & Dweck, 1975) have all been found to contribute to the reflective disposition.

While such findings would seem to support Kagan's proposal that conceptual tempo is a pervasive and useful dimension, other evidence has been found to challenge this position. Jones and McIntyre (Note1) argue that the MFF may actually be measuring differences in "game plans" and response biases rather than discriminative sensitivity, Using a visual running-memory-span task, they found that reflective and impulsive children differed only in response bias and latency, but not in recognition accuracy.

Kirasic and Siegel (1975) also investigated the influence of conceptual tempo upon recognition memory. Twenty-two reflective and 22 impulsive college students were given 96 cards, each containing a line drawing of some common animal or object. Each subject was told

to look at the cards, and go through the entire deck at his own pace. The test consisted of 96 cards on each of which were two pictures. One of these had appeared in the presentation deck and the other was either a different object (DO) or a picture that differed from the original only by 1, 2, or 4 features (1FD, 2FD, or 4FD). the task was to choose the picture that was in the original deck.

As predicted, performances on the DO and 4FD conditions were equivalent and significantly higher than those on the 1FD and 2FD conditions. Also as predicted, reflectives performed significantly better than impulsives only in conditions 1FD and 2FD, those requiring detailed visual analysis. Kirasic and Siegel concluded that the basis of reflection-impulsivity is the tendency to perform detailed visual analysis.

These results, however, may be questioned on several bases. Since a nonvisual task was not used to test the conclusion, it may be premature to assume that the differences in visual analysis form the basis of conceptual tempo or reflect the extent of its influence. Also, the conditions in which reflective and impulsive performance differences did not occur (DO and 4FD) employed easily distinguishable pictures. Presenting the correct and incorrect choices simultaneously in the forced choice procedure further simplified the task. If R-I differences appear only on tasks which produce a moderate degree of response uncertainty, these items may have been too easy. This task would be particulary simple for adult subjects who do not generally demonstrate the extreme impulsivity and resulting performance deficits found in some young children.

In order to test the above hypotheses and further explore the

extent of R-I influence, the present study employed two procedures which to our knowledge have not been previously used in the investigations of conceptual tempo. First, a sentence recognition task was used to determine if R-I differences extend to verbal memory. If reflective subjects perform significantly better than impulsive ones on such a task, Kagan's position that conceptual tempo reflects a broad cognitive predisposition would be supported. Secondly, the sentences were presented auditorily to one group and visually to another. If reflectives and impulsives score differently for the auditory presentation, Kirasic and Siegel's contention that conceptual tempo is based solely on visual processes could be challenged as being too strict an interpretation.

METHOD

Subjects

Fifty-seven undergraduate students enrolled in an educational psychology course participated in the research on a volunteer basis. The sample consisted of 38 females and 19 males with a mean CA of 23 years.

Procedure

R-I Classification. During the first testing session the adult form of the Matching Familiar Figures Test was administered individually to all 57 participants. Each subject was instructed to point to the only one of eight variants (on the bottom page) that was exactly like the standard (on the top page). Two examples and all 12 items were used. When the subject made an incorrect choice he was asked to make another selection. The experimenter recorded latency of the first response to each item as well as the number of errors.

R-I classification was then determined by the subject's total number or errors and mean response latency. Subjects who scored above the time median (43.5 secs.) and below the error median (5) were classified as reflective; those who scored below the time median and above the error median were called impulsive. Fast-accurates, slow-inaccurates, and those whose score fell at either median were excluded. Twenty reflective and 20 impulsive subjects remained in the final sample.

Stimulus Presentation. A recognition memory task was administered in a second session held approximately two weeks later. Ten reflective and 10 impulsive subjects were randomly selected for the visual presentation group. Stimuli for the two presentation modes were identical, each consisting of 36 concrete sentences in the following form: The (subject noun) (verb) a(n) (object noun). These sentences were presented in the same randomized order to all subjects. For the auditory presentation one of the authors other than the experimenter recorded the sentences on tape with an interval of five seconds between the beginning of each two consecutive sentences. This interval, which was long enough for the sentence to be spoken slowly with a short pause between sentences, was also used as presentation time for the visual mode. Each sentence was photographed upon a 35mm 2x2 slide and projected by a Kodak slide projector. Presentation of each sentence was timed with a stop watch.

Subjects met in groups of four to eight and received printed as well as oral instructions. Instructions for the visual presentation were as follows: "You are going to be shown some short sentences on slides. Each sentence will be projected for five seconds, and you are to read it carefully." For the auditory presentation, these directions

were given: "You are going to hear some short sentences on tape. Each sentence will be read only once, and you are to listen to it carefully."

An interpolated task (long division problems) lasting four minutes followed the sentence presentation.

Recognition Test. Subjects were then given an answer sheet and the following instructions: "Now you are going to see (hear) some more sentences. Some of them are exactly the same as those you have already seen (heard), and some have been changed. Mark an S on your answer sheet if the sentence is identical to one of those you saw (heard) before; mark a D on your sneet if it has been changed in any way. If you are not sure, guess."

The recognition test, which consisted of 84 sentences was presented to each group of subjects in the same mode as the stimulus presentaion had been made. All subjects saw (heard) the 84 test stimuli in the same randomized order. Presentation time for each sentence was lengthened to seven seconds to allow sufficient time for marking an answer. It was observed that this time interval provided all subjects with ample time to respond before the next sentence was presented.

Experimental Conditions. The recognition test was comprised of the 36 original presentation sentences and 12 sentences in each of four conditions.

Condition 1WD (one word difference): 12 sentences were randomly chosen from the original 36 and one word was replaced by a synonym. All synonym changes were controlled for word position. That is, each of the three major words (subject noun, verb, object noun) was changed an equal number of times.

Condition 2WD: 12 different sentences were selected from the original 36 and two words were replaced by synonyms. The combinations of subject noun and verb, verb and object noun, and subject noun and object noun were each changed in four of the 12 sentences.

Condition 3WD: the remaining 12 sentences were changed by replacing all three of the major words with synonyms.

Condition DS (Different sentence): 12 completly new sentences were composed in the same format and randomly interspersed with the other test stimuli.

These conditions were designed to be analogous to those employed by Kirasic and Siegel (1975). In the present study, however, the original stimulus was not presented simultaneously with the modified stimulsus as in the forced choice procedure used by Kirasic and Siegel (1975). As a result, the 36 original sentences comprised a fifth condition, (SS), same sentence.

Examples of presentaion stimuli and recognition test items:

1WD	Test item:
Presentation stimulus:	The student bought a test.
The student bought a book.	
2WD	
The leaves concealed a flower.	The leaves covered a blossom.
3WD	
The postmen delivered a package.	The mailman brought a parcel.

Tests were scored for number correct in each of the five conditions: SS, 1WD, 2WD, 3WD, DS.

The design was a 2x2x5 factorial with repeated measures on the last factor. The treatment groups were defined as all possible combinations

of two Conceptual Tempos (reflective, impulsive) and two Presentation Modes (visual, auditory). The repeated measure was Conditions (same sentence, one word difference, two word differences, three word differences, and different sentences).

RESULTS

A 2x2x5 mixed analysis of variance was conducted on proportion of correct responses as the SS condition contained 3 times as many sentences as the other conditions. The only significant main effect was for conditions, $F(3.108)=15.52$, $p<.001$. A Newman-Keuls analysis at the .05 level of significance revealed the following pattern of results: 1WD < DS = SS < 2WD = 3WD. This approximates the results obtained by Kirasic and Siegel (1975) in that performance is best with the most changes (3WD) and worst with the fewest changes (1WD). However, there are important differences. Performance in the DS and 3WD conditions were not equivalent and 2WD did not align with 1WD.

A disordinal interaction between Tempo and Stimulus Mode was marginally significant, $F(1,36) = 3.34$, $p<.10$. Visual inspection of cell means indicated a higher level of performance for reflectives under the visual presentation whereas impulsives performed better under the auditory presentation. Tests for simple effects revealed the differences between reflectives and impulsives under the auditory presentation to be significant while the differences between those two groups under the visual presentation was not significant. Also, those reflective subjects who were exposed to a visual presentation performed significantly better than those reflective subjects who were exposed to an auditory presentation while there were no differences for impulsives across modes.

Table 1 contains means and standard deviations for all experimental conditions. A 2 (R-I) by 2 (Presentation Mode) by 3 (Parts of Speech) mixed analysis of variance was performed on the number of correct responses for each type of word change within the iWD condition. The main effect of word position was highly significant, $F(2,72) = 11.47, p < .001$. A Newman-Keuls analysis at the .05 level of significance indicated that performance on sentences in which the verb had been changed was equivalent to performance on sentences with subject noun changes, and performance on both was significantly inferior to that on object noun substitutions (V = SN ON).

The stimulus mode by word position interaction was also significant, $F(2,72) = 3.14$, $p < .05$. Tests for simple effects revealed that subjects in the visual presentation mode recognized verb changes significantly ($p < .05$) more often than those in the auditory mode.

DISCUSSION

The fact that the main effect for Conditions in this study approximated that of Kirasic and Siegel (1975) makes their conclusion that visual feature analysis is the underlying basis for R-I somewhat less convincing. It would seem that subjects tend to recognize gross differences in stimuli more easily than subtle changes regardless of whether or not the task involves visual analysis. Failure to replicate their exact pattern of results may be related to the difference in testing procedures. Their simultaneous presentation of the original and altered stimuli might make an entirely new stimulus more obvious and thus comparable to the 3WD (or 4FD) condition. On the other hand, presenting a new stimulus alone would provide no basis for comparison and result in poorer performance for that condition.

Failure to replicate Kirasic and Siegels Tempo X Conditions interaction may also be due to a procedural difference. In the present study

presentation time for the stimuli was controlled. Had each subject been allowed to go through the stimuli at his own pace, reflectives might have studied the sentences more thoroughly than impulsives and given superior performances, especially in the more difficult conditions where greater response uncertainty exists.

The fact that R-I differences were obtained under an auditory presentation but not a visual presentation for a verbal recogntion memory task strongly suggests that R-I differences are not solely a function of visual analysis.

Since the main effect for conceptual tempo was nonsignificant, the usual superior performance of reflectives was not manifested in the present sentence recognition memory task, This is understandable since adult samples typically exhibit a more restricted range of R-I than children. The developmental trend toward the reflective end of the continuum (Kagan, 1965a) may serve to obscure R-I differences in these older subjects. Also, the limit on stimulus presentation times may have kept reflectives from demonstrating their usual superiority.

In spite of these circumstances, we might expect the R-I difference to be manifested in a more restricted or circumscribed way. This is exactly what happened when Tempo interacted with Mode. This result corresponds to earlier findings concerning reflective and impulsive differences in cognitive dispositions. Impulsives tend to be less flexible in their approach to problems (Davids, 1968; & Dweck, 1975) and spend less time analyzing or encoding the information. Reflectives, on the other hand, process information according to the demands of the task. Thus, when the present task was administered visually, reflectives may have relied primarily on visual memory. But when faced with an auditory presentation, they may have switched to

encoding for meaning (possibly using imagery), a strategy apparently more suited to the demands of the task. Impulsives, however, probably stayed with rote verbal rehearsal for both presentaion modes. Anecdotal evidence supports this hypothsis.

This explanation is also congruent with the data. On the one hand, the level of performance for impulsives did not vary as a function of presentation mode, whereas performance for reflectives did vary (superior under the visual presentation). On the other hand, impulsives outperform reflectives under the auditory presentation because rote rehearsal would better allow one to discriminate identical from changed sentences where the changes did not involve meaning. In other words, when one encodes for meaning but the task involves word recognition, performance is bound to suffer. The fact that there were no significant differences between reflectives and impulsives under the visual presentation suggests that they were using a similar strategy (rehearsal) but possibly of different types (rote verbal repitition for impulsives, visual plus verbal repitition for reflectives).

The slight superiority observed for reflectives might be made larger by increasing sample size, making the task longer or more difficult, or by letting subjects study the stimuli at their own pace.

Although visual analysis may be an important component of conceptual tempo on many tasks,our results are more consistent with the contention that R-I reflects a broad cognitive dispodition. It appears that this dimension may influence verbal process and is not based strictly on perceptual process.

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TABLE 1

Means and Standard Deviations of the Number and Proportion of Correct Responses for Reflectives and Impulsives in Each of the Experimental Conditions.

		Condition									
		SS		1WD		2WD		3WD		DS	
Group		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Reflective	Vis.	28.8 (80%)	10.33	7.7 (64%)	12.39	10.4 (87%)	11.91	10.3 (86%)	9.71	9.8 (82%)	23.91
	Aud.	25.9 (72%)	12.26	7.1 (59%)	10.01	8.8 (73%)	19.17	9.5 (79%)	10.59	8.4 (70%)	28.69
Implulsive	Vis.	26.7 (74%)	9.19	7.9 (66%)	17.66	9.6 (80%)	23.06	9.5 (79%)	18.54	9.1 (76%)	25.02
	Aud.	28.4 (79%)	11.18	7.8 (65%)	7.83	10.7 (89%)	8.90	11.0 (92%)	6.94	8.9 (74%)	25.30